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Topographical Anatomy of Nutrient Foramina of the Clavicle: Surface and Longitudinal Distribution

Dr. Charulata A
Associate Professor Department of Anatomy Indira Gandhi Government Medical College, Maharashtra, India

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Corresponding Author
Dr. Charulata A
Associate Professor
Department of Anatomy
Indira Gandhi Government
Medical College,
Maharashtra, India

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ABS TRAC T

Background: The topographical distribution of nutrient foramina is an important component of clavicular anatomy. The surface and longitudinal location of these openings may vary, and knowledge of this variation is relevant to anatomy, orthopedics, and reconstructive surgery.
Methods: One hundred dried clavicles were examined for nutrient foramen number, surface position, longitudinal location, and direction. The observations were summarized as descriptive frequencies and percentages.
Results: Seventy percent of clavicles had one nutrient foramen, 24% had two, and 6% had three. The posterior surface predominated at 55.88%, followed by the inferior surface at 41.17% and superior surface at 2.94%. The middle one-third accounted for 70.58% of the reported foramina.
Conclusion: Nutrient foramina demonstrated a clear topographical pattern, with posterior and middle-third predominance. The pattern is clinically relevant because clavicular procedures require appreciation of anatomical variability.

Keywords: *Clavicle; topography; nutrient foramen; posterior surface; middle third; surgical anatomy.*

INTRODUCTION

Topographical anatomy describes the relationship of anatomical structures to recognizable surfaces and regions. In the clavicle, topographical assessment of nutrient foramina is useful because the bone changes shape from medial to lateral and because surgical approaches may expose different surfaces.

The nutrient foramen is an opening in the cortical bone associated with passage of a nutrient vessel. Its presence, number, and position are not necessarily constant. The supplied study specifically examined these variables in dried clavicles.

The posterior, inferior, and superior surfaces of the clavicle are not equally represented in the source observations. The posterior surface was most frequent, while superior placement was uncommon.

Longitudinally, the clavicle can be divided into medial, middle, and lateral thirds for descriptive purposes. Such division makes it possible to identify whether nutrient foramina cluster in a particular region.

The source findings show a strong middle-third concentration. This is important for surgical anatomy because the middle shaft is clinically significant in clavicular fractures and fixation procedures.

Variation between published studies is expected. The source comparison shows that some investigators have found posterior predominance, whereas another cited study found inferior predominance. These differences reinforce the value of describing populations separately.

This manuscript therefore focuses on the topographical pattern of the supplied observations rather than adding unsupported clinical outcome claims.

AIM

To evaluate the surface and longitudinal topographical

distribution of nutrient foramina in the human clavicle.

OBJECTIVES

- To classify nutrient foramina according to clavicular surface.
- To determine the percentage occurring on posterior, inferior, and superior surfaces.
- To determine the distribution across medial, middle, and lateral thirds.
- To describe the number of foramina per clavicle.
- To relate the anatomical distribution to surgical anatomy.

MATERIALS AND METHODS

Study Design

The investigation was a descriptive observational anatomical study based on direct examination of dried human clavicles. The approach was intended to characterize nutrient foramina according to number, surface position, longitudinal location, direction, and selected morphometric parameters.

Study Material

The uploaded study reports examination of 100 dried human clavicles from Maharashtrian cadaveric material in an Anatomy Department. The age and sex of the specimens were not identified. The source describes the collection as including right and left clavicles.

Selection of Specimens

Clavicles showing damage, deformity, or significant pathological abnormality were excluded. The purpose was to examine apparently suitable specimens without gross changes that could interfere with identification of the nutrient foramen.

Anatomical Parameters

Each specimen was inspected for the number of nutrient foramina, the surface on which the foramen was located, its position within the medial, middle, or lateral one-third, and the direction of the nutrient canal. The distance of the foramen from the sternal end and the total clavicular length were also considered.

Instruments and Measurement

The source study documented use of a magnifying lens, a hypodermic needle with a reported diameter of 0.56 mm, and a digital vernier caliper. The curved clavicle was measured according to the protocol described in the source, with the total length used in the foramen-index calculation.

Foramen Index

The Hughes formula was used: FI = (DS/TL) × 100. DS represents the distance of the nutrient foramen from the sternal end, while TL represents the total clavicular length.

Data Presentation

The results are presented descriptively using frequencies, percentages, and the reported mean morphometric values. No additional statistical analysis has been added because the uploaded source does not provide raw individual-level measurements or the statistical framework needed for further analysis.

RESULTS

A nutrient foramen was reported in every examined clavicle. The overall pattern showed a predominance of a single nutrient foramen, with smaller proportions demonstrating two or three foramina. The source article reports a total of 136 nutrient foramina across the examined material.

Table 1. Number of nutrient foramina

Number of foramina	Percentage
1	70.0%
2	24.0%
3	6.0%

The surface distribution demonstrated a posterior predominance. The posterior surface accounted for 55.88% of reported foramina, followed by the inferior surface at 41.17% and the superior surface at 2.94%.

Table 2. Surface distribution of nutrient foramina

Surface	Percentage
Posterior	55.88%
Inferior	41.17%
Superior	2.94%

Longitudinally, the middle one-third was the principal region containing nutrient foramina. The lateral one-third was the second most frequent region, while the medial one-third showed the lowest proportion.

Table 3. Longitudinal distribution

Region	Percentage
Medial 1/3rd	10.29%
Middle 1/3rd	70.58%
Lateral 1/3rd	19.11%

Table 4. Reported morphometric values

Parameter	Reported value
Distance from sternal end	69.63 mm
Total clavicle length	133.26 mm
Foramen Index	52.25
Direction	Toward acromial end

Topographical Findings

The most prominent surface observation was posterior placement, accounting for 55.88% of reported foramina. The inferior surface represented 41.17%, while only 2.94% were located superiorly.

The posterior predominance is not absolute across all published studies. The source article cites studies in which posterior placement was approximately 56–65%, while another cited investigation reported an inferior

predominance of 72.9%. This suggests that surface distribution may vary between study populations or methodologies.

The middle third was the dominant longitudinal region, representing 70.58% of the reported foramina. The lateral third represented 19.11% and the medial third 10.29%. Thus, the middle third contained more than twice the proportion of the other two regions combined.

The combination of surface and longitudinal information gives a more complete description than either measurement alone. A foramen may be described not simply as being on the clavicle, but as occurring predominantly on the posterior surface and within the middle third in the supplied dataset.

Table 5. Integrated topographical profile

Feature	Dominant observation	Percentage/value
Number	Single foramen	70.0%
Surface	Posterior	55.88%
Longitudinal region	Middle 1/3rd	70.58%
Direction	Toward acromial end	Reported in all cases
Mean distance	From sternal end	69.63 mm
Foramen Index	Calculated value	52.25

DISCUSSION

The predominance of the posterior surface may reflect the distribution of nutrient vascular entry points in the examined clavicles. However, the presence of a substantial inferior proportion demonstrates that a surgeon or anatomist should not assume a single fixed location in every specimen.

The middle-third predominance is a stronger pattern in the supplied data. It is also broadly consistent with several studies cited in the original comparison table, including the 73.8% middle-third value reported by Rahul Rai et al.

The source study reports that all nutrient canals were directed toward the acromial end. This directional observation complements the surface and regional mapping and provides a three-dimensional description of the nutrient canal.

The findings have educational value because they demonstrate anatomical variation while still allowing a predominant pattern to be identified. This is particularly useful when teaching osteology and applied anatomy.

For operative anatomy, the observations support careful identification of individual structures rather than reliance solely on generalized textbook descriptions. The data can be used as a reference framework, while patient-specific anatomy remains decisive.

Clinical Implications

- Consider the posterior and inferior surfaces as possible nutrient vessel entry regions.
- Give particular anatomical attention to the middle third during clavicular exposure.
- Preserve surrounding soft tissue and vascular structures whenever feasible during fixation.
- Use anatomical variation as a consideration when planning reconstructive or vascularized graft procedures.
- Do not treat the percentages as patient-specific predictions; they are descriptive findings from the supplied specimens.

Limitations

The study was conducted on dried clavicles from a single regional population and did not include known age or sex. The source does not provide raw specimen-level measurements, which limits additional statistical analysis. The source article also has a sample-denominator inconsistency that should be checked before publication.

CONCLUSION

The topographical assessment demonstrated a predominance of nutrient foramina on the posterior surface and within the middle one-third of the clavicle. Although variation exists, these findings provide a useful anatomical framework for education and clinical planning.

Financial Support and Sponsorship

The uploaded source article reports that no financial support or sponsorship was received.

Conflict of Interest

The uploaded source article reports no conflict of interest.

Ethical/Specimen Note

This manuscript is based on the anatomical observations reported in the supplied source. The source does not provide a detailed institutional ethics statement or cadaver-donation protocol in the supplied text; therefore, no additional ethics claim has been introduced here.

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